Near-Infrared Observations of the Venus Surface and Lower Atmosphere

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Near-infrared (NIR) thermal emission from the night side of Venus at wavelengths near 1.0, 1.10, and 1.18-pm originates primarily from the surface and lowest scale height of the atmosphere. The Infrared Imaging Spectrometer at the Anglo-Australian Telescope was used to acquire moderate-resolution ($\lambda/\Delta\lambda$=400), NIR (0.9 to 2.5 pm) spectral image cubes of the night side during the 1991 and 1993 inferior conjunctions. Images extracted at wavelengths near 1.0, 1. L and 1.18-pm reveal intensity variations produced by cloud opacity differences and elevated topographic features including Beta Regio, Phoebe Regio, and Aphrodite Terra'. High-elevation regions are 20 to 50% darker than the surrounding plains because they are up to 40 K coder. Large reductions in the surface emissivity at high-elevations (>50%). like those seen at microwave wavelengths. could also modulate the observed emission. These low-emissivity regions have been attributed to either conductive surface weathering products, or volume scatterers embedded within the surface. The first of these could have *a* distinct NIR signature. while the second should not. Scattering by the H_2SO_4 clouds limits the spatial resolution to -100 km, but atmospheric seeing further limits our spatial resolution to -250 km. Scattering by the clouds and continuum absorption by gases also attenuate the observed emission and reduce the contrast, but these data still resolve regions with elevation differences of -1 km. We used a radiative transfer model to simulate the observed intensities and contrasts for a variety of topographic elevations (O to 6 km), surface emissivities (0.06 to 0.5), geoid temperatures (725 to 740 K), vertical temperature gradients (7 to 9 K/km) and H_2O amounts. We find that the atmospheric temperature lapse rates are marginally-stable (8 K/km) in all regions occupied by large-scale topography. The H_2O mixing ratios appear to decrease slightly with altitude, from about 45 ppmv at the surface to about 30 ppmv at the top of the first scale height (-16 km), but this concision is very dependent on the assumed CO_2 far-wing and continuum opacity near the surface. We find no evidence for large NIR surface emissivity variations (>1OYO) that are spatially correlated with known microwave low-emissivity regions.

1. Meadows, V.S. et al. **International Colloquium on Venus,** LPI Contribution. No 789,70-71,1992